Serial No.: 09/995,361

AMENDMENTS IN THE DRAWINGS:

Filed concurrently herewith is a formal request for approval of the following drawing changes:

In Figs. 4A and 4B, add the general reference label --80--.

Serial No.: 09/995,361

AMENDMENTS IN THE SPECIFICATION:

Paragraph beginning at page 1, line 24,

Recently, the applicant has developed a magnetron that is suitable for operating at frequencies heretofore not possible with conventional magnetrons. This high frequency magnetron is capable of producing high efficiency, high power electromagnetic energy at frequencies within the infrared and visible light bands, and which may extend beyond into higher frequency bands such as ultraviolet, x-ray, etc. As a result, the magnetron may serve as a light source in a variety of applications such as long distance optical communications, commercial and industrial lighting, manufacturing, etc. Such magnetron is described in detail in commonly assigned, copending United States patent application Serial No. 09/584,887, filed on June 1, 2000, <u>now U.S. Patent No. 6,373,194,</u> and Serial No. 09/798,623, filed on March 1, 2001, <u>now U.S. Patent No. 6,504,303,</u> the entire disclosures of which are both incorporated herein by reference.

Paragraph beginning at page 6, line 9,

As is shown in Fig. 1, the phaser 22 serves to output optical radiation 24 such as coherent light in the infrared, ultraviolet or visible light region, for example. The optical radiation is preferably radiation which has a wavelength $\underline{\lambda}$ corresponding to a frequency of 100 Ghz or more. In a more particular embodiment, the phaser 22 outputs optical radiation having a wavelength in the range of about 10 microns to about 0.5 micron. According to an even more particular embodiment, the phaser 22 outputs optical radiation having a wavelength in the range of about 3.5 microns to about 1.5 microns. However, it will be appreciated that the phaser 22 has application even at frequencies substantially less 100 Ghz.

Paragraph beginning at page 7, line 1,

Referring now to Figs. 2 and 3, a first embodiment of the phaser 22 is shown. The phaser 22 includes a cylindrically shaped cathode 40 having a radius rc <u>(see, Fig.</u>

3). Included at the respective ends of the cathode 40 are endcaps 41. The cathode 40 is enclosed within a hollow-cylindrical shaped anode 42 which is aligned coaxially with the cathode 40 relative to axis A. The anode 42 has an inner radius ra (see, Fig. 3) which is greater than rc so as to define an electron interaction region or anode-cathode space 44 between an outer surface 48 of the cathode 40 and an inner surface 50 of the anode 42.

Paragraph beginning at page 7, line 9,

Terminals 52 and 54 respectively pass through an insulator 55 and are electrically connected to the cathode 40 to supply power to heat the cathode 40 and also to supply a negative (-) high voltage to the cathode 40 as seen in Fig. 2. The anode 42 is electrically connected to the positive (+) or ground terminal of the high voltage supply via terminal 56 (see, Fig. 2). During operation, the power supply 32 (Fig. 1) applies heater current to and from the cathode 40 via terminals 52 and 54. Simultaneously, the power supply 32 applies a dc voltage to the cathode 40 and anode 42 via terminals 54 and 56. The dc voltage produces a dc electric field E which extends radially between the cathode 40 and anode 42 throughout the anode-cathode space 44.

Paragraph beginning at page 7, line 18,

The phaser 22 further includes a pair of magnets 58 and 60 located at the respective ends of the anode 42 as seen in Fig. 2. The magnets 58 and 60 are configured to provide a dc magnetic field B (see, Fig. 2) in an axial direction which is normal to the electric field E throughout the anode-cathode space 44. As is shown in Fig. 3, the magnetic field B is into the page within the anode-cathode space 44. The magnets 58 and 60 in the exemplary embodiment are permanent magnets which produce a magnetic field B on the order of 2 kilogauss, for example. Other means for producing a magnetic field may be used instead (e.g., an electromagnet) as will be appreciated. However, one or more permanent magnets 58 and 60 are preferred particularly in the case where it is desirable that the phaser 22 provide some degree of portability, for example.

Paragraph beginning at page 8, line 3,

The anode 42 has formed therein an even-numbered array of straight single-mode waveguides 59a and 59b (represented in phantom in Fig. 3). The waveguides 59a and 59b function as respective phasing lines and have dimensions which are selected using conventional techniques such that the waveguides operate in single-mode at the desired operating wavelength λ. The waveguides 59a and 59b extend radially (relative to the axis A) from the anode-cathode space 44, thru the body of the anode 42, to a common resonant cavity 66. In particular, each of the waveguides 59a and 59b include an opening at the inner surface 50 of the anode 42 into the anode-cathode space 44. At the outer surface 68 of the anode 42, the waveguides 59a and 59b open into the common resonant cavity 66. The openings of the waveguides 59a and 59b are evenly and alternately spaced circumferentially along the inner and outer surfaces of the anode 42. The gap between openings along the inner surface 50 is represented by Gp <u>as seem on Fig. 2</u>.

Paragraph beginning at page 8, line 16

As is represented in Figs. 2 and 3, the waveguides 59a (nominally referred to herein as even-numbered waveguides) are relatively narrow waveguides compared to the waveguides 59b (nominally referred to herein as odd-numbered waveguides). The widths of the waveguides are selected such that the odd numbered waveguides 59b have a width Wb <u>(see, Fig. 2)</u> which is greater than the width Wa <u>(also, Fig. 2)</u> of the even numbered waveguides 59a so as to provide an additional ½-λ phase delay compared to the even-numbered waveguides 59a at the operating wavelength λ. In the exemplary embodiment, four even-numbered waveguides 59a are arranged side-by-side in the axial direction along axis A, and three of the wider odd-numbered waveguides 59b are similarly arranged. It will be appreciated, however, that the particular number of waveguides arranged in the axial direction is a matter of choice and may be different depending on desired output power, etc.

Paragraph beginning at page 9, line 12,

The common resonant cavity 66 includes at least one or more output ports 74 (see, Fig. 2) which serve to couple energy from the resonant cavity 66 out through a transparent output window 76 as output optical radiation 24 (see, Fig. 2). The output port(s) 74 are formed by holes or slots provided through the wall of the resonant cavity structure 72.

Paragraph beginning at page 12, line 11,

Figs. 4a and 4b illustrate wedges that may be used to form the anode 42 in one embodiment of the invention. As is explained in the aforementioned U.S. ~~patent application Ser. No. 09/798,623~~ Patent No. 6,504,303, an anode similar to the anode 42 may be formed by a plurality of pie-shaped wedges. Likewise, the anode 42 may be formed by a combination of wedges 80a and 80b as shown in Figs. 4a and 4b, respectively.

Paragraph beginning at page 13, line 20,

Figs. 5 and 6 illustrate another embodiment of the phaser 22 having a different anode structure. More particularly, the phasing lines formed by the waveguides 59a and 59b in the previous embodiment are replaced by interdigital electrodes. The interdigital electrodes permit very fine electrode spacing independent of the operating wavelength λ. As there are many similarities between the respective embodiments described herein like reference numerals referring to like elements throughout), only the relevant differences will be discussed below for sake of brevity.

Paragraph beginning at page 13, line 27,

As is shown in Figs. 5 and 6, the phaser 22 includes permanent magnets 58 and 60 for providing the cross magnetic field B as seen in Fig. 5. Mounted concentrically about the axis A on each of the magnets 58 and 60 is a corresponding cylindrical pole piece 90 made of iron or the like. Each of the pole pieces 90 includes a smooth, highly electrically conductive cladding 92 made of silver or the like. The pole pieces 90 are

generally symmetric and face each other as shown in Figs. 5 and 6. The width W of the pole pieces 90 and corresponding cladding 92 <u>(see, Fig. 5)</u> defines a relatively wide anode-cathode space 44 therebetween.

Paragraph beginning at page 14, line 22,

According to the embodiment of Figs. 5-7, the radial distance from the electrodes 96 to the outer edge of the pole pieces 90 (inclusive of the cladding 92) is $\lambda/2$, for example (Fig. 7). The spacing S <u>(see, Fig. 7)</u> between the opposing faces 98 of the pole pieces 90 is slightly greater than $\lambda/4$ (to avoid electrode contact with the oppositely facing pole piece 90). As a result, the opposing faces 98 of the pole pieces 90 form a waveguide or parallel plate transmission line having a length along the radial direction of $\lambda/2$ which begins at the edge of the cylindrical cage formed by the electrodes 96 and opens into the common resonant cavity 66.